DOCUMENT RESUME

ABSTRACT
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corporate training; and (2) the line between academia and private industry is
blurring at an unprecedented rate that is strongly associated with the growth
of Web-based instruction and training. A review of Web-based instruction
efficacy indicates that, despite the prevalence of Web-based instruction,
there are few efficacy studies in which Web-based and face-to-face
instruction are compared. The paper describes views of educational
researchers who object to the utility of such studies on methodological and
theoretical grounds. Rationale for the need for such studies is also
presented. Four representative efficacy studies are summarized, and their
results, taken together, yield three principal conclusions: (1) Web-based
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students' grades and exam scores; (2) learning variables play an important
role in terms of the nature of students who select and who succeed in
Web-based classes; and (3) factors that lead to improved performance in
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also increase performance and positive attitude in Web-based courses.
Contains 17 references. (Author/MES)

running head: WEB-BASED INSTRUCTION

The Horse and the Cart in Web-Based Instruction: Prevalence and Efficacy

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Abstract

This paper consists of a review of current trends in web-based instruction and a review of a representative sample of web-based instruction efficacy research. The review of the current state of web-based instruction yields two principle themes: a) The prevalence of web-based instruction is growing exponentially, particularly in lifelong learning and corporate training; and b) The line between academia and private industry is blurring at an unprecedented rate, and the trend is strongly associated with the growth of web-based instruction and training. A review of research on web-based instruction efficacy indicates that, despite the prevalence of web-based instruction, there are few efficacy studies in which web-based and face-to-face instruction are compared. The paper describes views of some educational researchers who object to the utility of such studies on methodological and theoretical grounds. Rationale for the need for such studies is also presented. Four representative efficacy studies are summarized and their results, taken together, yield three principal conclusions. a) Web-based instruction can be as effective as face-to-face instruction based on students grades and exam scores; b) Learner variables play an important role in terms of the nature of students who select and the nature of students who succeed in web-based class; and c) Factors that lead to improved performance in face to face classes, such as structured collaboration and active learning also increase performance and positive attitude in web based courses.

The Horse and the Cart in Web-Based Instruction:
Prevalence and Efficacy

Prevalence

In one of the first, if not the first article to appear in a main stream academic education journal on the World Wide Web and education, Ron Owston led with what has become one of the most commonly quoted statements in articles covering this topic:

> *"Nothing before has captured the imagination and interests of educators simultaneously around the globe more than the World Wide Web"*
> *(Owston, 1997, p. 27)*

Ron Owston probably couldn't have guessed how much truer this statement would be by the turn of the century, just a few years later.

Virtually every major University now offers at least some on-line courses, and the web is also used extensively in "traditional" face to face classes. Further, a third of U.S. colleges now offer degrees online (Huffstutter & Fields, 2000). There are entire Universities that are primarily on-line, and, even traditional "brick and mortar" schools that are using the web as the primary delivery mechanism rather than the classroom and teacher approach. At Daniel Jenkins Academy in Florida, students will meet in a regular building according to a regular schedule, but will take all their classes on line (Thomas, 2000). Regular textbooks are being replaced by electronic texts on some campuses. For example, seven dental schools, including New York University and the University of Texas are planning to replace four years of medical text books with one DVD for incoming students (Guernsey, 2000).

A fundamental and growing trend that is strongly associated with the growth of the World Wide Web and instruction is the blurring of the lines between traditional academia and the business sector. A number of factors account for this trend, primary among these are the growing need for professional post-graduate training in today's high tech and quickly changing work world, combined with the low cost, convenience and efficiency of training provided via the Web. This is the principle reason that corporate training via the web grew almost five fold, from .19 billion in 1997 to 1 billion in 1999. Further, some project that this will grow to a whopping 11.4 billion by 2003 (Sambataro, 2000). John Chambers, the CEO of Cisco systems refers to "e-learning" as the second wave in the Internet after e-commerce. According to Chambers "The next big killer application for the Internet is going to be education. Education over the Internet is going to be so big it is going to make e-mail usage look like a rounding error" (Mccright, 1999).

In addition to growth within web-based training in the corporate world, more and more private enterprises are working their way educational arenas that have traditionally been the purview of traditional academia. For example, large web-based "learning hubs" such as Smart Planet (http://www.smartplanet.com) and Hungry Minds

(http://www.hungryminds.com) offer education of all sorts in areas as diverse as "how to find airline tickets" to links to University degree programs in computer science. Many of the courses are available for free because the sites rely on free education and a marketing technique. The company, notHarvard.com introduced the term "educommerce" to describe this business model (http://www.notharvard.com). Of course, such trends are diametrically opposed to the traditional notion that the academic world can and should maintain a fundamental independence from the corporate world. Whether academia is ready for it or not this model may be changing, and may be changing relatively quickly. In a recent article in the New York Times, Arthur Levine, the president of Columbia University, made the following troubling assessment of the current state of education, academia, and the business world.

> *You know, you're in an industry, which is worth hundreds of billions of dollars, and you have a reputation for low productivity, high cost, bad management and no use of technology. You're going to be the next health care: a poorly managed nonprofit industry, which was overtaken by the profit-making sector... Those of us in higher education have a small amount of time to stop and think. What is the purpose of higher education? How shall we continue to accomplish it? Not to answer these questions is to make a profound decision, by default, about our own prospects for the future.* (Levine, 2000)

Efficacy

The Case against Efficacy Studies

Amidst the dramatic changes in the nature and philosophy of higher education associated with the growth of the web in instruction, a central question remains. Are web-based learning techniques as effective as traditional face to face instruction? Of course, given that both face-to-face instruction and web-based instruction can vary widely in the nature of their instructional design, the more answerable question is, "**Can** web-based instruction be as effective as face to face?" or even more answerable, "Is web-based instruction in its current form as effective as face to face instruction, within the context of some subject domain."

Although such a question would seem on the surface to be an obvious and important first step in web-based learning, surprisingly few such studies have been conducted. One reason for this lack of research is probably due to the fact that some educational researchers deem such a comparison to be impossible due to inherent methodological and theoretical flaws. Richard E. Clark (1983; 1994) and others contend that it is impossible to separate the instructional media from the instructional technique, so that, for example, any comparison of web-based instruction to face-to-face instruction is actually a comparison of different instructional techniques and strategies that are brought about as a result of the media (Russell, 1999). As support for this contention they point to the bulk of instructional media studies that find no significant difference

between the use of different types of media. Further, others have complained that there is an inherent instructor bias in instructional media studies. First of all, media type is often confounded with instructor in such research. For example, if one instructor creates or moderates a web-based class and another instructor teaches the face to face class in a comparison study, it is impossible to tell if outcome differences are due to instructor or media. Further, if the same instructor is used for both conditions, there is often a bias in that the instructor is the one who has invested time and effort in creating the media, or, is in some other way biased in favor of the media group. This creates a bias in terms of motivation and expectancy on the part of the instructor. Finally, it is also often impossible to randomly assign students to web-based versus face-to-face classes for pragmatic and/or ethical reasons, and self-selection biases occur. In fact, the survey of studies below indicates that there are substantial differences between those who select web-based classes as compared to face to face.

The Case for Efficacy Studies

Despite these objections there remain a number of arguments in favor of carrying out efficacy studies in some form. First, given the trends cited above, and the large amount of resources invested in web-based education, many in the society who are effected by web-based instruction (e.g., parents, educators, government leaders) are calling for evaluation of the use of the web in education. Despite methodological flaws, many educational researchers would argue that we owe it to the society at large to do our best to evaluate these techniques carefully, and to share our findings, while emphasizing important qualifications in interpretation.

There have always been methodological limitations within applied education research studies, particularly when a new instructional technique is examined, whether it involves instructional media or not. However, many researchers still see the need for ecologically valid studies conducted in applied contexts, and view the methodological limitations as challenges that can be addressed in many creative ways. This same philosophy can be applied to efficacy studies involving web-based education. One strategy is simply to present the findings within the context of these limitations, so that the researcher emphasizes that the results must be considered with given qualifications. Further, applied research that is lacking in the systematic controls and rigor of more basic educational and cognitive research can serve as one component of a larger research design, which includes more basic research. Combining applied and basic research aimed at examining such phenomena as web-based instruction can serve as a very powerful tool for discovering important factors in accounting for the efficacy of such techniques. Finally there are many creative alternative research tools that the applied research can use in studies of web-based instruction such as the measurement of multiple outcomes and leaner variables, and subjective-quantitative and qualitative techniques.

Representative Studies Description

Introduction. Below I will review and summarize four web-based vs. face-to-face comparison experiments. This is not an exhaustive review by any means; however, the number of such studies is surprisingly small. The first experiment was selected because it received a lot of publicity within popular education literature, and the second study was selected for inclusion because it was conducted specifically in an effort to replicate the first. The third experiment was selected due to the focus on learner variables, and the fourth was slected since it is almost surely the largest, comprehensive study conducted up until the present.

Schutte (1996). One of the first comparison studies of web-based and traditional face to face instruction was carried out by Jerald G. Schutte in 1996 in a Sociology Statistics class. His results received a lot of attention in educational circles and the popular press including an article in the Chronicle of Higher Education (1997). Schutte randomly divided students into a web-based vs. face-to face class and found that students in the Web-based class performed dramatically better. They scored 20% higher on both the mid term and final tests. Those in the Web class were also significantly more positive on self-report measures of math attitude, and also, surprisingly, reported significantly more contact with class members than those in the face to face class. Those in the web-based class also reported spending significantly more time on the class.

Unfortunately most of the press about this experiment did not point out that some aspects of this study almost certainly preclude the conclusion that the web-based instruction is significantly more effective than face to face, even within the context of this specific class. As others have pointed out (Neal, 1998), there were substantial, not so subtle, differences between the web and face to face classes independent of the World Wide Web. Those in the face to face class only met once a week on a Saturday for several hours, and spent the whole time working math problems. Those in the web class also worked these same problems and submitted them via web forms. In addition, those in the web class did email assignments in 3 person groups that included generating weekly reports, responded to a weekly discussion topic twice a week, and participated in a web-based chat session with the instructor once a week. The problems in experimental design in this study are obvious, nevertheless, I do believe the experiment adds useful information to the body of knowledge on web-based instruction. Among other things, the experiment demonstrates that fundamental principles of effective instruction within a face-to-face class, such as encouraging active learning and collaboration on the part of learners extends to web-based instruction as well.

Jones (1999). In an effort to replicate Schutte's experiment, Edward Jones carried out a similar Web vs. face-to-face comparison within an undergraduate statistics class. One fundamental difference between the experiments was that students in the Jones experiment were not randomly assigned to groups. The format for the web class was similar to Schutte's in that it included on-line lecture notes, quizzes, a discussion listserver, email, and biweekly chat sessions. Unfortunately, there is not much detail listed in the research report with respect to the face to face class, or whether or not the students in the web class were simply required to carry out more activities and

assignments than the face to face class, such as was clearly the case in the Schutte experiment.

Due to the fact that the Jones experiment did not use random assignment, demographic variables were considered. In fact, some of the most interesting findings of this experiment involved the demographics in providing information about students who selected web-based class versus face to face. Jones found that those who selected the web course were significantly older and also had significantly higher GPAs. In terms of outcomes, those in the Web-Based groups scored significantly higher on exams, when GPA was not taken into account. However, when GPA was considered as a covariate, differences between the groups on exam scores were not significantly different, and, in fact, the adjusted mean for those in the face to face class on the final was slightly higher than for those in the Web class.

White (1999). This experiment consisted of a comparison of a WWW class with a face to face class in *Communication, Technology, and Change*. As with the Jones experiment, students were allowed to select their instructional modality (web vs. face to face), and the researchers considered demographic variables in an effort to control for these selection effects. The web-based lessons included text lectures with images, links to related sites, and discussion questions posted to a listserve. Unfortunately, there is no description of the face-to-face class in the research report beyond the fact that they did not have access to the web materials.

Those who selected the web based classes scored significantly higher on pretests of reported computer usage, and significantly lower on reported computer apprehension and communication apprehension. However, unlike the Jones study, the groups did not significantly differ in GPA. Interestingly, the significant difference on computer apprehension between those who selected the Web-Based versus face-to-face class disappeared on the post-test. Computer apprehension for those in the face to face class decreased from pre to post test and increased for those in the web-based class! The groups did not significantly differ on mid term and final exam scores.

Wideman & Owston (1999) (also reported in Owston, 2000). This study constituted what is probably the largest and most comprehensive comparison of web-based versus traditional instruction to date. The study included 14 different classes, each of which was offered in a web-based format and in a corresponding face to face or traditional correspondence (paper) format. The study included 1099 students in web-based courses, 2467 students in correspondence courses, and 2318 students in face to face classes. The web courses used Lotus Learning Space and typically weekly lessons were posted, a study schedule, weekly readings, lectures, and occasionally graphics. The courses included electronic discussion rooms but the authors note that the use of the rooms varied widely across web classes.

An initial analysis of course grades found that students in the correspondence courses scored significantly lower than the other two modalities, which did not

significantly differ. Further examination of the data indicated a large number of zero scores in the web-based classes. Though no official records were retained, the researchers discovered that most of these zeros were assigned to students who dropped out of classes. A second analysis was conducted, which did not include stidemts wotj grades pf zero. In this analysis grades were significantly higher for the web-based classes than for the face-to-face classes, which were significantly higher than for the correspondence classes.

Conclusions Based on Representative Studies

The results of the studies summarized above, taken together, yield the following general conclusions.

- Students in web-based courses perform as well as those in traditional classes, based on performance on tests and class grades.

- Learner variables play an important role in selection of, and performance in, web-based courses.

  - those who select web courses are more computer savvy, older, and are, in some cases, better students (i.e., higher GPA)
  - Students in web-based courses are more likely to drop out; indicating that self-motivation may be a more important factor in performance in web-based classes than in traditional classes.

- Factors that lead to improved performance in face to face classes, such as structured collaboration and active learning also increase performance and positive attitude in web based courses.

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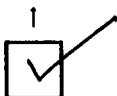| Corporate Source:	Publication Date:

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